The supply chain of violence

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Nathalie Butt*[1,2], Frances Lambrick[3], Mary Menton[4], Anna Renwick[1]

[1] School of Biological Sciences, Goddard Building, University of Queensland, St. Lucia, Qld, 4072, Australia

[2] School of Geography and the Environment, Dyson-Perrins Building, University of Oxford, OX1 3QY, United Kingdom

[3] Not1More, Abacus Court, Bull Street, Harborne, Birmingham, B17 0HH, www.not1more.org

[4] Sussex Sustainability Research Programme, University of Sussex, Falmer, Brighton BN1 9RH, UK

Every year, more people are killed defending the environment than are soldiers from the UK and Australia, combined, on overseas deployments in war zones. During the last fifteen years, the number of both deaths of environmental defenders, and the countries where they occur, has increased: recorded deaths have increased from two per week to four per week over this period. The reasons for these deaths are primarily related to conflict over natural resources, across a range of sectors but in particular mining and agribusiness: > 230 deaths, of a total of 683, between 2014 and 2017. We find that, importantly, rule of law and corruption indices are most closely linked to patterns of killings. Using spatial data, we investigate the drivers of these conflicts and violence, seek to identify who may be most at risk, and why, and argue that businesses, investors, and national governments at both ends of the chain of violence need to be more accountable.

Main

Between 2002 and 2017, 1558 people in 50 countries were killed for defending their environments and lands[1] (Supplementary Table 1), more than double the number of UK and Australian armed service people killed on active duty, in war zones over the same period (*n*=697;[2,3]), and almost half as many as the number of US soldiers killed in Iraq and Afghanistan since 2001 (*n*=4044 [4]). 'Environmental defenders' here refers to people engaged in protecting land, forests, water and other natural resources. This includes community activists, members of social movements, lawyers, journalists, non-governmental organisation (NGO) staff, park rangers, Indigenous peoples, members of traditional, peasant and agrarian communities, and those who resist forced eviction or other violent interventions. These people take peaceful action, either voluntarily or professionally, to protect the environment or land rights[1]. They may be directly involved in working on the land, or represent those who do, or be advocates for conservation of habitats or species.

The forms of violence (direct, structural, cultural) and the typologies of the harm caused (e.g. physical, psychological) are examined in detail elsewhere[5-7]. Here, we distinguish between larger-scale violence linked to armed conflicts (civil, guerrilla or inter-nation) rooted in struggles over natural resources, and that aimed at individuals or particular communities or groups of individuals due to their acts of resistance and/or protection of their land or environmental rights. Environmental defenders currently face a wave of violence, which also includes threats of physical harm, intimidation, and criminalisation[8,9] (Figure 1). Here we focus on the killings of environmental defenders, which have been documented since 2002 through the work of Global Witness, UK, the Comissão Pastoral da Terra (Pastoral Land Commission), Brazil, the Guardian, UK, and others. Deaths represent the 'tip-of-the-iceberg' of the violence that environmental defenders currently face: for every defender murdered, thousands more face direct violence, threats and psychological intimidation, and more invisible cultural and structural violence, or 'slow violence'[10]. This violence is driven by natural resource exploitation, and we here examine the particular conditions, sectors and interactions leading to deaths of defenders. Using global datasets, we analyse the drivers of violence contributing to killings of environmental defenders. While other studies have looked at the links between authoritarianism and killings of environmental defenders[11], and the relationship between economic growth and these deaths[12], we further this analysis by evaluating the relationship between spatial factors (i.e. natural resource distribution, e.g. hectares of agricultural cultivation, area of mining concessions) and killings, and how we may begin to address the situation at a global level.

Natural resource conflicts

Conflicts over natural resources are linked to different resources and/or sectors (e.g. fossil fuels, minerals, timber, agriculture, aquaculture, water), and access to land and/or bodies of water from which natural resources can be extracted[13]. These conflicts can be seen as the continuation of colonial land and resource appropriation that established systems of dispossession and control – including displacement, forced labour and denial of native and Indigenous rights; private control and exploitation of land and natural resources with state backing (e.g. the Congo Free State under King Leopold II of Belgium); benefits of natural resource exploitation in one nation accruing to another nation; and a global shift from communal to private land rights[14]. Developed countries' resource consumption is outsourced to less wealthy nations and regions[15].

As such, conflicts often arise around the extraction of resources by companies or others without legitimate user rights to the resource (e.g. illegal logging in community forests), or when user rights are granted by corrupt governments (e.g. access to water already used by communities), or through political processes that fail to respect Free Prior Informed Consent (FPIC) (e.g. oil drilling in concessions in Indigenous territories in Peru[16,17]). In other cases of conflict, traditional natural resource users are excluded from the land, often in the name of conservation in national parks, or marine protected areas that restrict fishing activities (e.g. evictions of Indigenous Sengwer from their traditional forest lands, Kenya[18,19]). Some conflicts surround benefit-sharing from extractive industries (e.g. Panguna mine owned by Rio Tinto subsidiary BCL in Papua New Guinea[20]), while in others, it is the indirect effects of the extraction that lead to conflicts (e.g. water pollution caused by mining or oil drilling, air pollution from factories). In some more extreme cases, extractive industries can lead to displacement of communities either through contamination of rivers and lands that makes an area uninhabitable (e.g. Chevron and Texaco in Ecuador and Peru; [21,22]), or by flooding of entire communities for

the creation of hydroelectric dams (e.g. the Belo Monte dam, Pará, Brazil; the Lower Sesan II dam, Strung Treng, Cambodia; [23,24]). In addition to local or national industrial drivers based on these natural resources, multinational corporations that directly outsource their resource exploitation can play a significant role in violence against environmental defenders[21].

In many cases, environmental conflicts do not lead to physical violence. However, in cases with intractable conflict, which cannot be solved through various social, administrative or legal processes[25], violence can emerge. Three conditions increase the chances of violence against defenders: i) strong incentives (financial, political, other) by government and private actors to exploit natural resources; ii) marginalisation (economically, culturally, politically) of those who depend most on natural resources and; iii) weak rule of law (corruption, lack of enforcement, impunity)[1,8,9]. Using global datasets on variables related to deforestation rate, corruption indices, allocation of land concessions, agri-business commodity prices and other potential drivers, we explored spatial relationships between governance, natural resource sectors, and deaths, to identify key interactions.

Drivers of environmental defender deaths

In 2017, at least 185 environmental and land defenders were killed[1], and of these, Indigenous peoples died in higher numbers than any other group (approximately 40% of deaths in 2015 and 2016, and 30% of deaths in 2017). Regionally, most of these deaths were in Central America (36%), followed by South America (32%), and Asia (31%); the Philippines and Colombia had the greatest number of Indigenous deaths overall (36 and 22, respectively) during 2015-2017.

The availability of data on murders of environmental defenders is limited by research effort (contacts, languages spoken), the extent of free media, and presence of human rights monitors in some countries. Countries with the lowest protection for press and NGOs have the highest corruption scores[26]. The data are likely to be underestimates, and countries that appear to have the highest number of killings may in fact be those with a free press; apparent increases in numbers of murders may be due to improvements in reporting.

The key natural resource sector drivers of violence and deaths vary by country or region (Figure 2). For the period 2014-2017, the most deaths linked to the agriculture sector were in the Philippines and Brazil (Figure 3a); Brazil is also the country with the most deaths in the logging sector (Figure 3b). For mining and extraction, the most deaths were in the Philippines, Colombia and India (Figure 3c), while Guatemala and Honduras had the most deaths related to water and dams (Figure 3d). Poaching-related deaths were most frequent in Vietnam and the DRC. Although there is some correlation between the spatial distribution of natural resource extent and exploitation, and number of deaths of environmental defenders locally, there is no global universal pattern between spatial extents of resource sectors.

Using all deaths data, for 2002-2017, Kendall's tau analyses revealed significant correlations between deaths per million and rule of law (p=6.396e-07; τ=0.34), and deaths per million and area harvested (p=0.00163; τ=0.22): these two drivers are themselves closely correlated (p=0.00062; τ=0.21), although we note that correlation does not equate to causation. There was some correlation between deaths per capita and dams (p=0.04223; τ=0.20), but none between deaths per million and mining or intact forest (p=0.2197; τ=0.17 and p=0.4014; τ=0.01, respectively). Welch t-test analysis of binary deaths and rule of law showed significant

difference between the two groups (p=2.057e-09; t=6.47), and for rule of law and area harvested (p=0.0297; t=-2.24).

A country's rule of law was the key variable associated with environmental deaths (Figure 4a and 4b). While there was a strong correlation (P<0.0001) between the countries with the most deaths and their rule of law score, ([27] accessed 15/10/2018), it may be also the case that the most corrupt countries are so dangerous and have such weak rule of law that there is less environmental activism, e.g., Somalia, North Korea and Afghanistan. There was a clear positive correlation between economic development and safety[28], but even countries that are not deemed very corrupt can see brutal crimes against environmental defenders (e.g., Ireland). All except three (n=47) of the countries where deaths have been recorded are classed as highly corrupt, in that their Corruption Perceptions Index score fell below 50 on a 0-100 scale[26].

Discussion

Weak rule of law is identified as an important condition leading to violence against defenders. The level of impunity in the killings of environmental defenders is high: globally on average it is estimated that just over 10% of these murders result in a conviction [29], which is low compared to global homicide convictions, which was 43% on average in 2012[30]. Impunity in these cases of violence against environmental defenders is linked to two main factors. Firstly, corruption within police and judiciary branches in many countries means that cases are not properly investigated or tried, and indeed sometimes it is the police and/or government authorities who are directly responsible for the violence, or have financial and or familial ties to those responsible. The massacre of ten land activists at Pau D'Arco, Pará, Brazil, 24th May 2017, is one instance where civil police are the main suspects [31]. Secondly, because they are linked to

natural resources, many murders occur in remote areas with weak government and police presence, which adds to the difficulty of gathering evidence. In Brazil, consistently the country with the highest number of killings of environmental defenders, especially Indigenous peoples, the election of Jair Bolsonaro raises new concerns as he promises to relax gun laws and environmental protections while labelling NGOs and activists as terrorists[32], in order to undermine and repress those in disagreement with the political regime[11]. In the Philippines there was a 71% increase in the number of murders of environmental defenders from 2016 to 2017 under Rodrigo Duterte, who has taken a violent stance toward human rights defenders, Indigenous peoples, environmentalists, women, drug users, and others.

Indigenous peoples manage or have tenure rights over at least ~38 million km^2 globally, about a quarter of the world's land surface, which overlaps with about 40% of all terrestrial protected areas and ecologically intact landscapes[33]. Additionally, conflict over natural resources and land often arises due to failure to recognize Indigenous land rights, or poor law enforcement to protect those rights. Although evidence is increasing that Indigenous Territories are equally, or more, effective at conserving forests than state managed protected areas[34], continuing lack of rights, repression and marginalisation, and liberalization of external investment in land-based sectors means that these groups are more subject to high levels of violence with impunity[11]. Indigenous rights infringements and resulting violent conflict is also apparent in the global North: in the United States, the Standing Rock resistance to the North Dakota Access Pipe Line was forcefully repressed with use of water cannon in sub-zero temperatures; many demonstrators were hospitalized.

The cause of deaths is primarily conflict over resources as local communities and defenders are not consulted, and instead often violently silenced. It should be noted that although no

deaths have yet been recorded in the US or the UK we see environmental rights there being eroded, and environmental defenders increasingly being deemed criminals. For instance, in September 2018 in the UK, historic jail sentences were handed down to three anti-fracking protestors in the UK, convicted of causing a public nuisance following their non-violent direct action to prevent hydraulic fracking at Preston New Road, Lancashire; the first environmental activists to receive jail sentences for a protest in the UK since 1932 (for land trespass)[35]. This situation gives rise to grave concerns around the impacts on sustainable development and UK (in)action on meeting the country's climate change commitments.

Local or national variables contributing to environmental conflict include corruption and land tenure allocations. International and multinational companies that profit from natural resources sourced under conditions that infringe defenders' rights in one country and sold elsewhere are complicit in driving violence through their supply chains, and have a responsibility to act transparently and ethically. There is a clear need for a global perspective on natural resource conflicts, recognising transboundary impacts, and teleconnections. The current displacement of environmental and social damage, from countries in the global North to countries in the global South, is a result of globalisation, and longer historical trends such as colonialism, and is increasing as trade and consumption grow[36]. The correlation between rule of law and area harvested in our analysis reflects this relationship. This global perspective needs to be further explored in both academia and the non-academic world: transparency across all aspects of environmental conflict is necessary[37].

Conclusion

People are dying to protect their livelihoods, and the forests, lands and ecosystems that provide for our future. These killings are on the scale of armed conflict – defined as 25 killings per

year[38]: 56 environmental defenders were killed in Brazil and 47 people in the Philippines in 2017. This study offers a novel global analysis of the drivers of violence, showing that corruption and rule of law are significant predictors of environmental defender deaths. To address this situation, governments, businesses and investors need to be held accountable for their role in supply chains that drive violence.

The voices and actions of those at the frontline of environmental protection are violently suppressed by powerful actors: the hard end of a continuum of inequality[11]. The silencing of voices proximate to the frontline is of global concern: if people are afraid to speak up or campaign, this could lead to the silencing of important environmental issues even in theoretically safe countries; it undermines international conventions, such as the Convention on Biological Diversity, and efforts to meet the Sustainable Development Goals.

The natural resource sectors shown to play a role as underlying drivers are implicated in these murders. All companies should be accountable for the impact their business practices have, and one way of addressing the issue could be through international schemes and legislation for environmental protection, to which all companies would be required to be signatories. In addition to threats against people, global trade puts biodiversity at risk[39]. Use of new laws such as the Global Magnitsky Human Rights Accountability Act[40], set up as an anti-money laundering mechanism and as a way of penalising perpetrators of human rights abuses, offer new routes to accountability, and to protecting environmental defenders. This type of provision could be a model for international legislation on environmental harm to create accountability for industries targeting natural resources in conditions of weak local rule of law – conditions that result in deaths of defenders. Companies and consumers must investigate the sources of their products, publish the results and commit to eliminating violence from their supply chains.

Methods

The natural resource sector drivers of conflict are categorised as 'agribusiness', 'logging', 'mining and extraction', 'poaching' (often combined with 'fishing'), 'water and dams', and 'other', by Global Witness[1]. We extracted spatial data on each of these four natural resource sectors from freely available online resources, using relevant indicators: area harvested, intact forest, mining concessions, and major dams. Data on environmental defender deaths were provided by Global Witness. We calculated rates of death per million population for each of the 50 countries where killings had taken place. For Indigenous groups, we extracted death data for available years, 2015-2017, and calculated: proportions of total killings, by country, and by region (Supplementary Table 2).

We investigated the link between environmental defender deaths and corruption using rule of law, based on eight factors: constraints on government powers, absence of corruption, open government, fundamental rights, order and security, regulatory enforcement, civil justice, and criminal justice[27]. The data were partial in some cases, for example, rule of law indices and dam numbers were not available for all countries, including for Honduras and Guatemala, even though that sector was recorded as the key driver of deaths in those countries, and so we included in our analyses all countries with data available for two or more of the five potential drivers. We used Kendall's tau analysis to identify significant correlations, and Welch's t-test to identify significant differences between grouped data. For absolute deaths and rule of law (i.e. using only data from the 50 countries where deaths had occurred), we used a GLM.

Data availability

The data that support the findings of this study are available from the corresponding author upon request, and were sourced from the following organisations.

For environmental defender deaths: https://www.globalwitness.org;

for area harvested (http://www.fao.org/faostat/en/#data/QC);

for intact forest (http://www.intactforests.org/data.ifl.html);

for mining concessions

(https://data.globalforestwatch.org/datasets/26a457ee3b584824bb930f2ec791b60d_0);

for major dams

(http://data.globalforestwatch.org/datasets/537361e2df59486e898cd4e024af57ea_0);

for Rule of Law index: https://worldjusticeproject.org/our-work/wjp-rule-law-index

Please address correspondence and requests for materials to n.butt@uq.edu.au

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Author contributions

NB, FL, MM planned the work, AR and NB analysed the data, all authors contributed to the writing.

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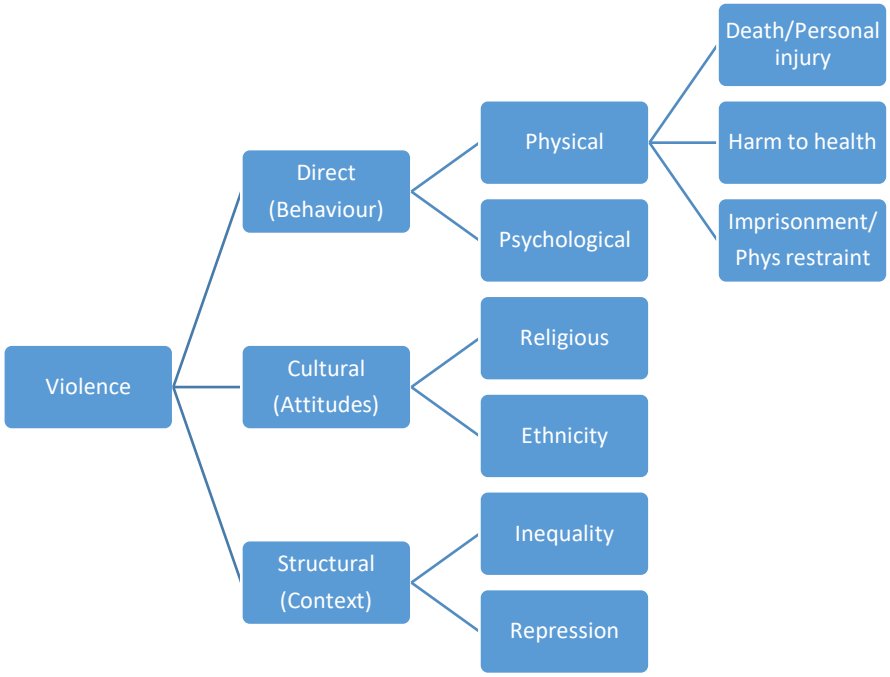
Figure legends

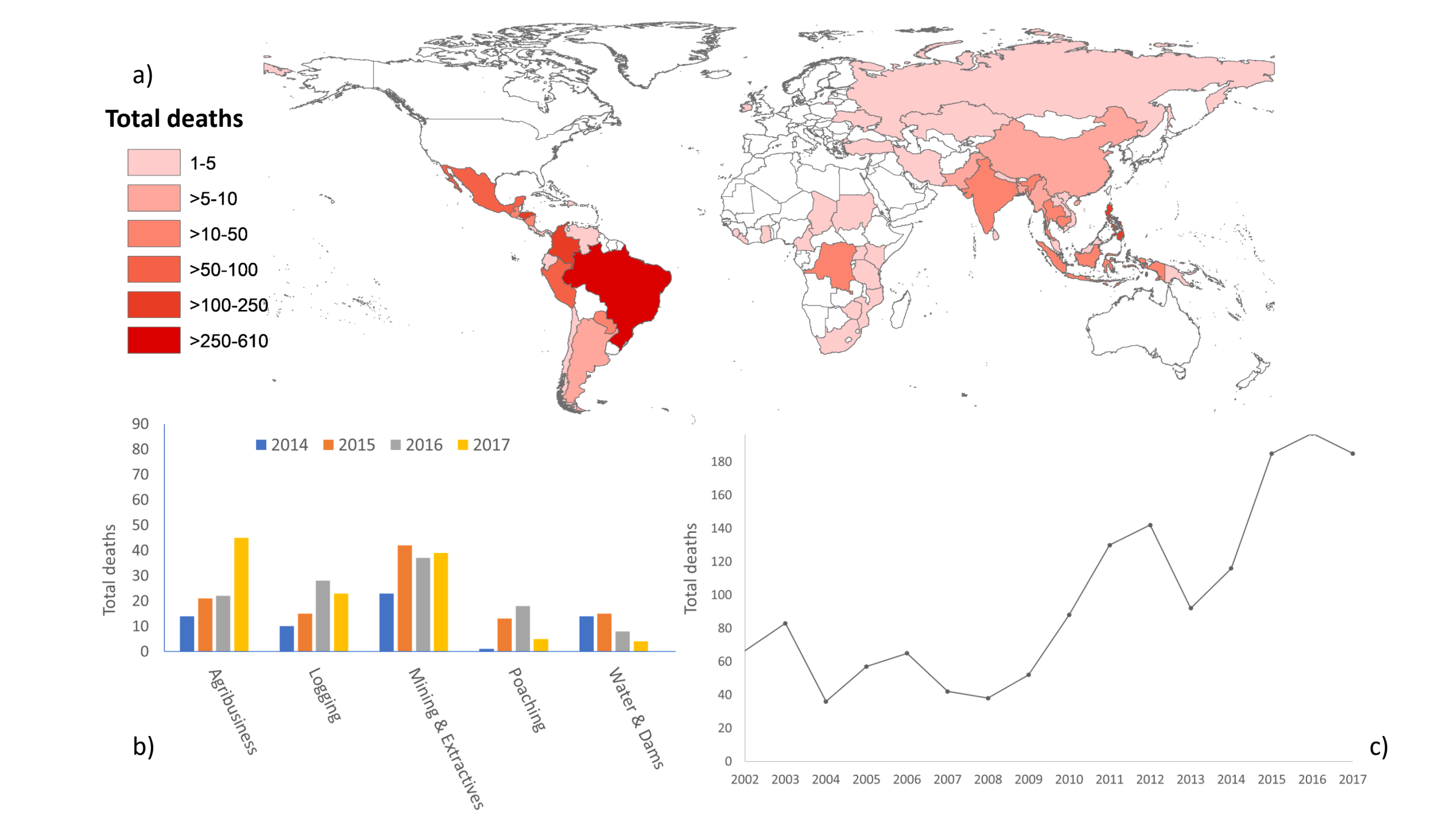
Figure 1: Typology of violence. Violence can be manifest in different forms all of which can be linked to violence against environmental defenders who often include Indigenous peoples / ethnic minorities (cultural violence) and economically marginalised groups (structural violence). Herein, we focus on direct physical violence which leads to death which is the 'tip of the iceberg' of the violence experienced by environmental defenders.

Figure 2: For 2014-2017, spatial distribution of deaths by prominent key natural resource sectors: (a) agribusiness, logging, mining and extractive industries, water and dams, and poaching; (b) global total number of deaths by key natural resource sector; (c) total number of deaths between 2002 and 2017.

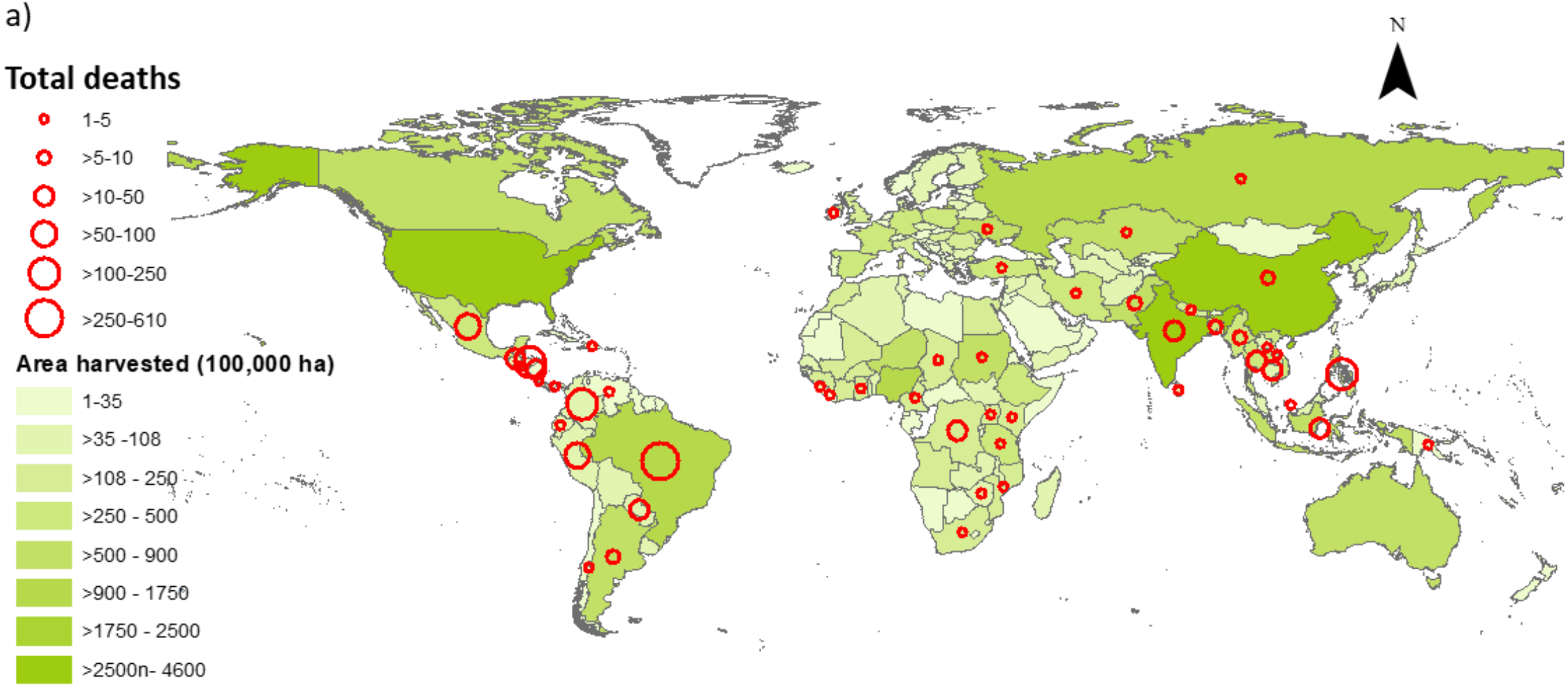
Figure 3: Global overlay of environmental defender deaths 2014-2017 and natural resources drivers: a) agriculture (as area harvested). The most deaths in this sector were in the Philippines (*n*=39); b) logging/land clearance (as intact forest). The most deaths in this sector were in Brazil (*n*=41); c) mining/extraction. The most deaths in this sector were in Colombia (*n*=25) (as reserves/concessions); d) water and dams (major dams shown). The most deaths in this sector were in Guatemala (*n*=12) and Honduras (*n*=12). See Methods for data sources.

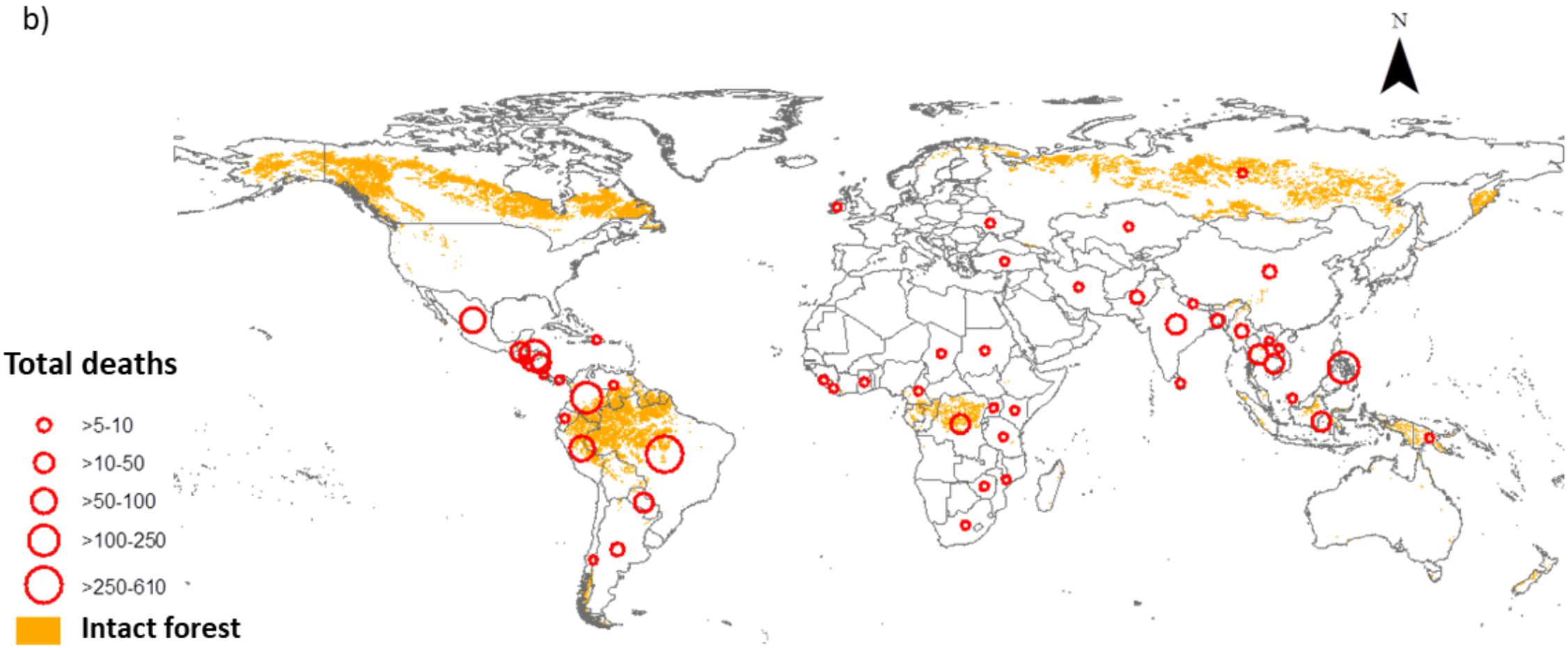
Figure 4: Rule of Law overall score. This incorporates data from eight categories: absences of corruption, civil justice, criminal justice, fundamental rights, government powers, open government, order and security, regulatory enforcement. a) Countries in the darker colours have a higher index, and are more likely to be peaceful, safe and equitable, whereas countries in the lighter colours have a lower index and are less likely to be peaceful, safe and equitable. The map shows that there are more deaths in lighter-coloured countries, particularly in tropical and subtropical regions. b) A fitted GLM clearly indicates the correlation between numbers of deaths and Rule of Law. (Source: World Justice Project).


Violence
Direct (Behaviour)
Cultural (Attitudes)
Structural (Context)
Physical
Psychological
Religious
Ethnicity
Inequality
Repression
Death/Personal injury
Harm to health
Imprisonment/ Phys restraint

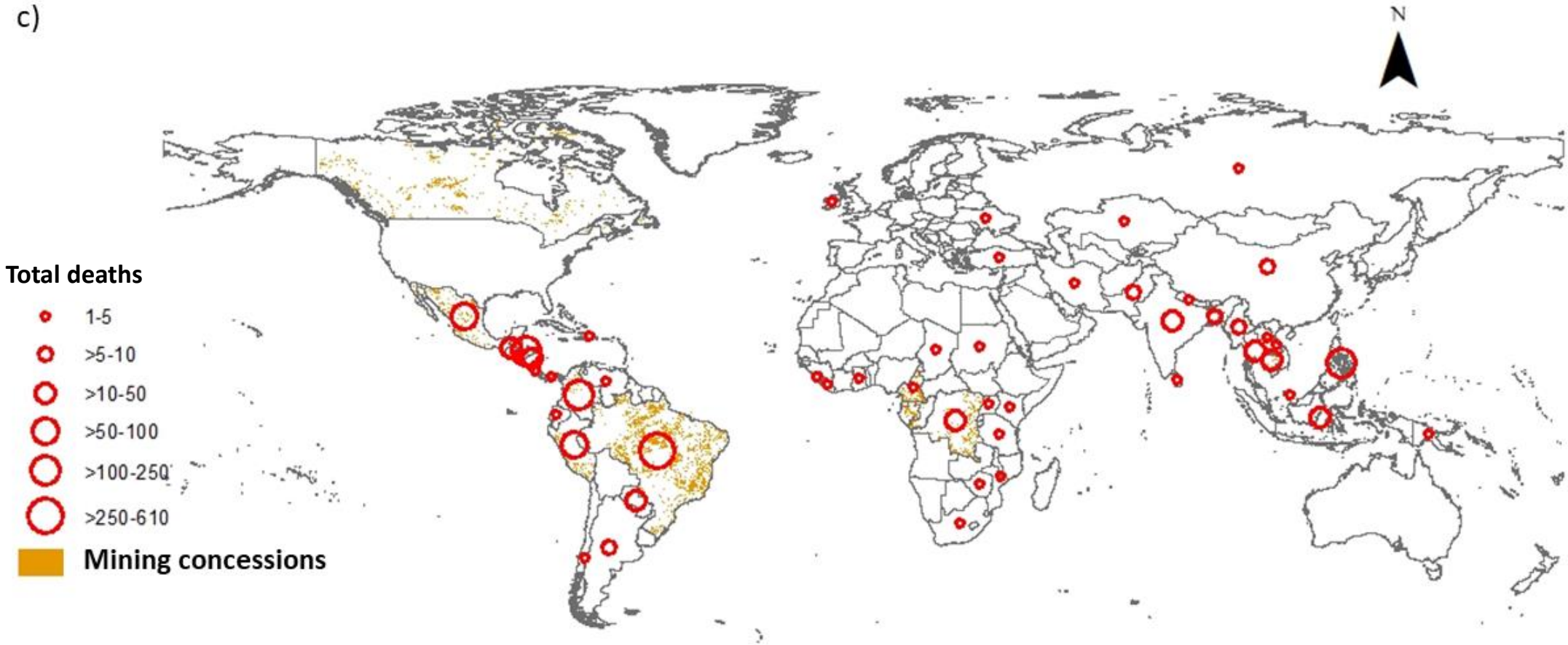

a)
Total deaths
1-5
>5-10
>10-50
>50-100
>100-250
>250-610
b)
Total deaths
2014
2015
2016
2017
Agribusiness
Logging
Mining & Extractives
Poaching
Water & Dams
c)
Total deaths
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

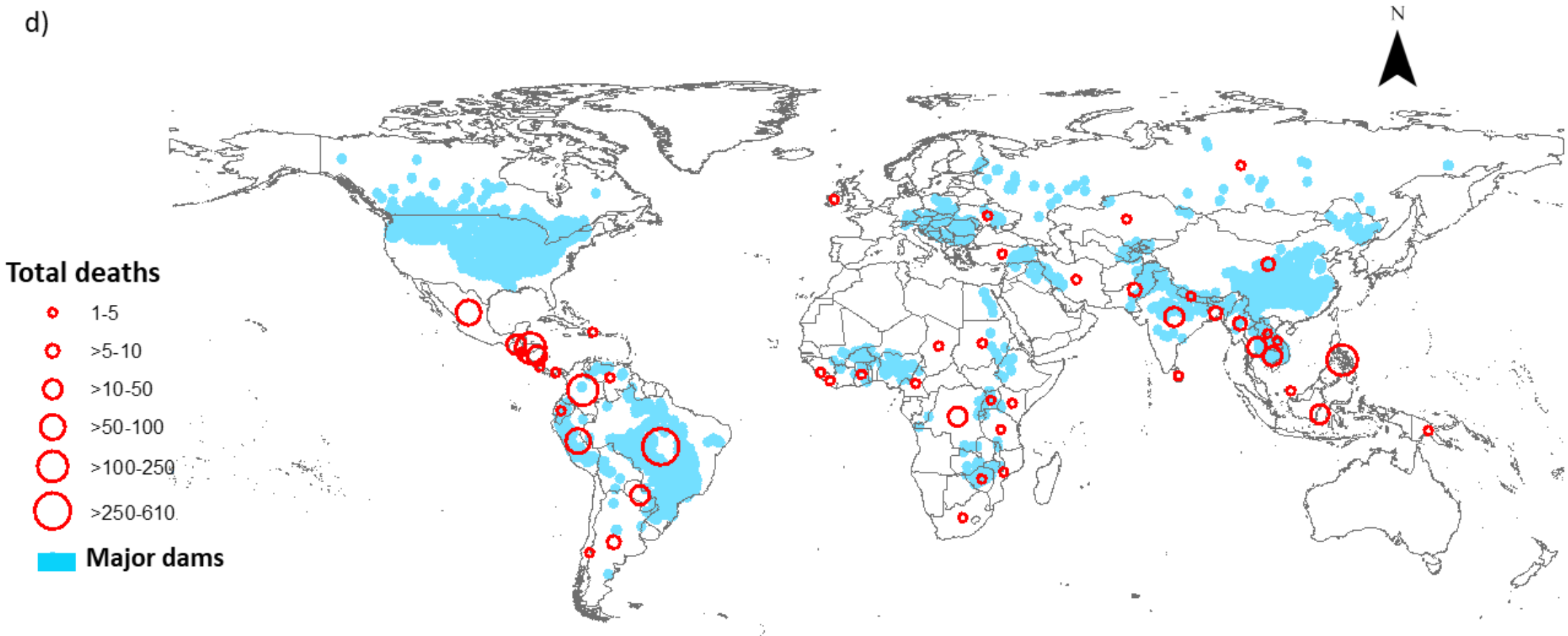
a)

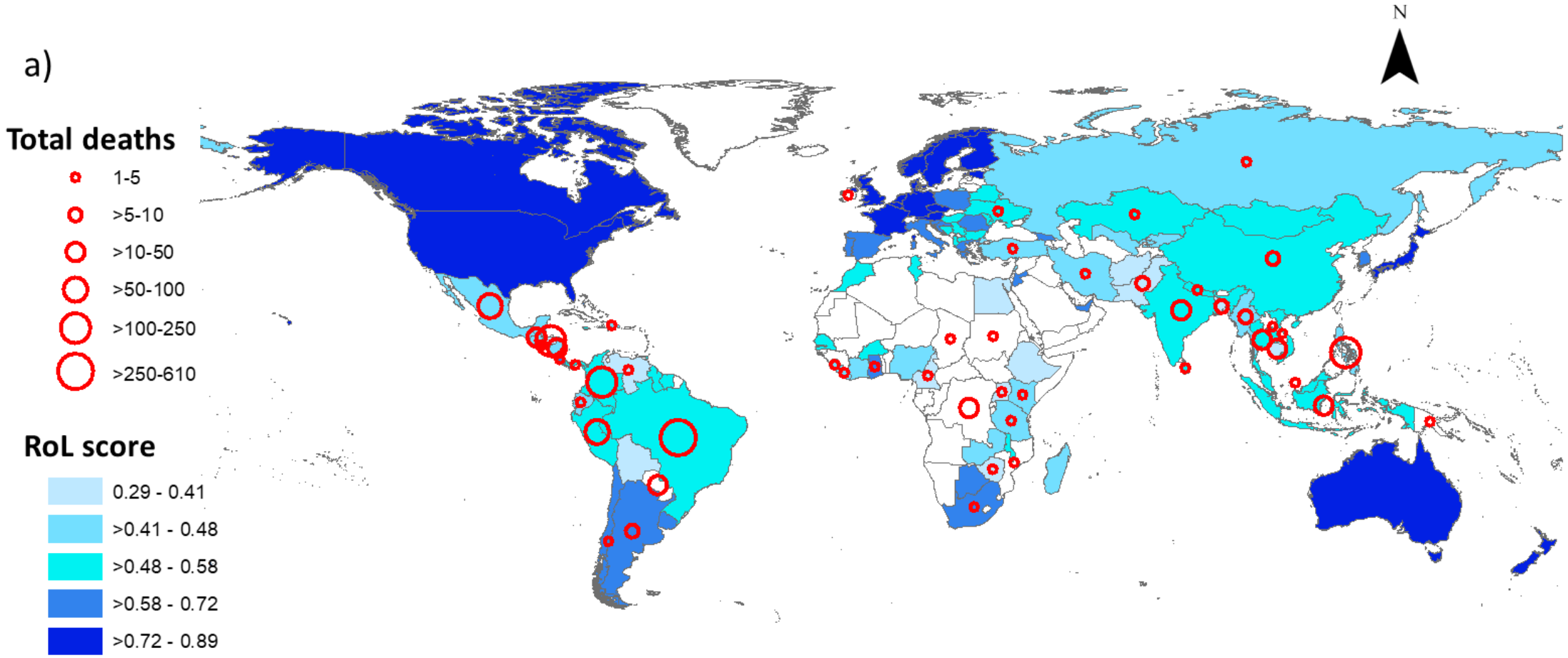

Total deaths
1-5
>5-10
>10-50
>50-100
>100-250
>250-610
Area harvested (100,000 ha)
1-35
>35 -108
>108 - 250
>250 - 500
>500 - 900
>900 - 1750
>1750 - 2500
>2500n- 4600
N


b)
N
Total deaths
>5-10
>10-50
>50-100
>100-250
>250-610
Intact forest

c)


N
Total deaths
1-5
>5-10
>10-50
>50-100
>100-250
>250-610
Mining concessions


d)
N
Total deaths
1-5
>5-10
>10-50
>50-100
>100-250
>250-610
Major dams


a)
Total deaths
1-5
>5-10
>10-50
>50-100
>100-250
>250-610
RoL score
0.29 - 0.41
>0.41 - 0.48
>0.48 - 0.58
>0.58 - 0.72
>0.72 - 0.89
N

b)